memorandum

248-3684

Ontario

To: See Distribution List

Date: 86 11 03

File: 4201-13

From: Concrete Section
Engineering Materials Office
Room 111, Central Building
Downsview

Re: Report of the Task Force on Concrete Lighting Poles

In May 1986 we distributed MI-90 "Concrete Lighting Poles, A Condition Survey" which gave details of a survey of our concrete poles in the Toronto and Hamilton areas. The survey was carried out for a task force set up by the Structural Management Committee. We now attach a copy of the task force report and recommendations.

The Structural Management Committee supports the recommendations and meetings will be held with the pole manufacturers to discuss positive action to improve the durability of concrete poles.

Further copies of MI-90 are available from this section if required. Copies of ME-85-04 are available from the Engineering Research and Development Branch.

R P Northwood

R. P. Northwood
Head, Concrete Section

RPN/mc
Attachment

REPORT OF THE TASK FORCE ON CONCRETE LIGHTING POLES

Introduction

On November 28, 1983 the Structural Management Committee established a task force to review concerns regarding the deterioration of concrete lighting poles. The task force consisted of R. Northwood, D. Manning and D. McCune. The terms of reference were to review the situation and to identify any action to be taken in three areas:

1. Rating System

   - to establish economical, non-destructive testing methods to be used to identify those poles requiring repair or replacement.

2. Repair Methods

   - to develop economical methods of rehabilitating deteriorated poles.

3. State-of-the-Art

   - to determine the state-of-the-art and examine alternative longer life pole designs.

1. Rating System

A review of a detailed report on "Concrete Illumination Pole Deterioration" prepared in 1983 by D. Aspinwall showed that there is no evidence of sudden unexpected failure of concrete poles. Poles deteriorate at different rates but the deterioration is progressive and visually evident. Initially poles develop cracks and rust stains. These are followed by progressive spalling of the concrete and eventually holes develop in the walls of the pole. Poles can be surveyed by non-destructive testing methods such as covermeter surveys, impact hammer surveys, corrosion potential surveys and delamination surveys. However in the case of concrete poles, the cost of such testing is not justified, and a simple visual inspection is sufficient. Many poles are located in high traffic areas and visual inspection has the advantage of being faster and safer than other methods.

The task force developed a rating system based on visual inspection of the physical deterioration of the pole. To assist with the subsequent tasks, the task force arranged for district forces to carry out a survey of the majority of concrete poles owned by the Ministry using the new rating system. The rating system and the details of the survey are described in the report M.I. 90. "Concrete Light Poles - A Condition Survey" by S. Cripps and R. P. Northwood which is appendix A to this report.

...2/-

2. Repair Methods

The task force identified three possible options for repairing deteriorated poles, patching, jackets, cathodic protection and replacement.

a) Patching

Patching alone will not stop the progressive deterioration of poles. Since it does not extend the life of the pole or significantly reduce the risk of failure, it is not recommended.

b) Jackets

In 1983 a trial project to construct concrete jackets identified problems with this technique. It was difficult to remove unsound concrete without punching through the shell. Not only is this type of repair expensive, but it will not slow down deterioration significantly and only provides some reinforcement to the damaged pole. Many poles show distress for the full height of the pole and obviously full height jacketing is uneconomical.

The task force discussed repair techniques with 3 major authorities who own large numbers of poles. Metro Toronto and North York Hydro have been unable to find viable repair techniques. They replace poles with severe deterioration. Toronto Hydro do repair poles by patching and jacketing. They explained that if a pole does deteriorate to the extent that it collapses, the hydro wires normally support the pole so the risk of injury to the public is very low. They stated they would not recommend repairing free-standing poles adjacent to traffic as the risk of collapse is too high.

The task force concluded that for reasons of safety, economy and practicality jacketing could not be recommended.

c) Cathodic Protection

If a cheap, effective means of cathodic protection were available, it could be used to prevent the rusting of the reinforcing steel which is a major cause of deterioration. The Research and Development Branch are actively developing various cathodic protection methods and a trial installation has been in place on a concrete pole for about 2 years. The technique appears promising and a report will be issued shortly. The Condition Survey shows that poles subjected to severe exposure conditions deteriorate faster and such poles should be given priority for protection when a suitable method is developed.

A progress report ME-85-04 "The Development of a Cathodic Protection System for Concrete Light Poles - An Interim Report" by F. Pianca, constitutes Appendix B to this report.

...3/-

d) Replacement

The cost of replacing a damaged pole with a new concrete or steel pole is about $4,000 if several poles are replaced at the same time. District 6 Maintenance have been actively replacing their worst poles. They have replaced 50 poles in the past 2 years and will replace a further 30 poles in 1986. They then expect no further severe problems for several years. The condition survey shows that there are fewer damaged poles in District 4 than District 6. Since most of our poles are in these two districts, a replacement policy for the most seriously damaged poles would appear to be reasonable for the Ministry's present needs.

Recommendation

All poles with a rating of 4 or 5 on the rating scale should be replaced. If a suitable cathodic protection method is developed, poles with a rating of 3 should be protected. Poles with the worst exposure should be given priority for protection.

Because existing poles will continue to deteriorate, a visual inspection and condition rating (according to Table 2.1 of Report MI-90) should be carried out at 3 year intervals beginning in 1988.

3. State-of-the-Art

The condition survey showed that poles exposed to salt splash deteriorate faster than less exposed poles, however, age itself is not a major factor in deterioration. There are many poles with about 20 years of service which are still in excellent condition. Other poles placed more recently show extensive deterioration. The task force has concluded that the major factor in premature deterioration is the quality of manufacture of the pole over which, the Ministry has little control. We could improve the quality of the poles we buy, by specifying epoxy coated steel and the use of concrete sealers, and by vigorous inspection during manufacture. We suspect, however, that these concrete poles would then be less competitive than steel poles and our own inspection costs would be higher. Based on the industry's record to date, the task force considers that even if coated steel were used for the main reinforcement, there might still be problems with pole durability from time to time, because of the relatively unsophisticated method of manufacture.

J. Heaton from the Concrete Section is a member of the Canadian Standards Association committee responsible for the CSA Standard for Concrete Poles. He will be pressuring the committee to take action to make these poles more durable.

...4/-

Steel poles have been used since about 1967. Apart from some surface rusting, durability has been excellent and the task force has found no reports of failure in service. Steel poles cost about $250 more than concrete. This extra cost is less than 10% of the total instalied cost. Concrete Poles are unsuitable for high mast lighting installations and steel poles will be used for these installations.

Recommendation

The Ministry should use steel poles rather than concrete poles whenever possible. Where concrete poles must be used, epoxy coated steel reinforcement should be specified and the poles should be sprayed with a suitable concrete sealer before use. Report MI-79 "A Laboratory Evaluation of Concrete Surface Sealants" by A. Bradbury and B. Chojnacki contains a list of sealants which proved satisfactory in laboratory tests.

RPN/mc
86 06 11